

Technical Note

Determining Creep Reduction Factor for Tri-Planar Geonets

In this technical note, the Creep Reduction Factor, RF_{cr} is determined to account for the creep that takes place in a tri-planar geonet between the seating period of 100 hours and two time periods. The first case is to represent the initial phase of waste placement, and the second case is to represent the stage of the landfill prior to final closure where waste thickness reaches its maximum height. The reduction factor for creep is then applied to the transmissivity value determined from performance test with a 100-hour seating to account for the creep deformation.

The attached Figure shows the results of 10,000-hour compressive creep tests on tri-planar geonets under normal loads of 2,000psf and 25,000psf respectively. The creep curve under 2,000psf load is used to determine the creep reduction fact for the first case (initial phase of waste placement), and the creep curve under 25,000psf is used for the second case (landfill prior to final closure). The following Equation¹ is used to determine the Creep Reduction Factor, RF_{cr}

$$RF_{cr} = \left[\frac{(t_{CO} / t_{virgin}) - (1 - n_{virgin})}{(t_{cr} / t_{virgin}) - (1 - n_{virgin})} \right]^3$$

Where:

t_{CO} = thickness after load application for 100 hours

t_{virgin} = initial thickness under 2.9 psi (ASTM D5199)

¹ Giroud, J.P., Zhao, A., and Richardson, G., 2000, "Effect of Thickness Reduction on Geosynthetic Hydraulic Transmissivity", Special Issue on Liquid Collection Systems, *Geosynthetics International*, Vol.7, Nos. 4-6, pp. 433-452.

t_{CR} = thickness at the time period of interest

n_{virgin} = initial porosity

Case 1: Using the compressive creep curve under 2000psf load (Initial Phase of Waste Placement):

$$t_{CO} = t_{100h} = 7.62 * 0.975 = 7.43 \text{ mm}$$

$$t_{\text{virgin}} = 7.62 \text{ mm (300 mils)}$$

$$t_{CR} \text{ (use 4,000 hours)} = t_{4000h} = 7.62 * 0.965 = 7.35 \text{ mm}$$

$$n_{\text{virgin}} = 0.75 \text{ (calculated)}$$

Substituting these values in the above Equation:

$$RC_{CR} = \mathbf{1.05}$$

Case 2: Using the compressive creep curve under 25,000psf load (Landfill Prior to Final Closure):

$$t_{CO} = t_{100h} = 7.62 * 0.7 = 5.32 \text{ mm}$$

$$t_{\text{virgin}} = 7.62 \text{ mm (300 mils)}$$

$$t_{CR} \text{ (use 17,000 hours)} = t_{17000h} = 7.62 * 0.675 = 5.14 \text{ mm}$$

$$n_{\text{virgin}} = 0.75 \text{ (calculated)}$$

Substituting these values in the above Equation:

$$RC_{CR} = \mathbf{1.20} \text{ (for landfill prior to final closure)}$$

Compressive Creep Data on Tendrain

